A DECISION SUPPORT SYSTEM FOR STOCK MARKET INVESTMENT

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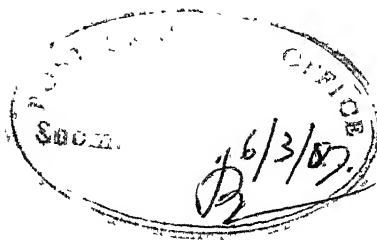
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CERTIFICATE

This is to certify that this work entitled, A DECISION
SUPPORT SYSTEM FOR STOCK MARKET INVESTMENT , by S.Govinda
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it has not been submitted elsewhere for the award of a
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ABSTRACT

A Decision Support System for share market investment has been developed. The system implements many concepts of Fundamental and Technical approaches of share evaluation. It also applies basics of Ratio Analysis, Managerial Finance and Portfolio Management. The systems utility lies in its user friendlyness and enabling the user to control the process of decision making. The feature that enables the user to seek information about the underlying concepts in decision making and the terminology adds to the power of the package. This package uses its own database consisting of information about various scrips and the user can update the database as and when the latest data pertaining to the firms in the database is sought. The system has been implemented on a Personal Computer in BASIC language.

ORGANIZATION OF CONTENTS

The work is divided into six chapters. First chapter provides basic information with regard to shares and the stock exchanges. The second chapter discusses various approaches of stock evaluation and their relative merits and demerits. Chapter three gives how the problem has been structured and how the DSS has been designed to fulfil the requirements of an investor. Chapter four discusses the implementation of the package - the methodology, system and language in which the package has been developed, the structure of the database, data collection and manipulation etc. Important features and limitations have been covered in Chapter Five. In Chapter Six, the scope for further work and concluding remarks have been given.

CHAPTER I

INTRODUCTION

1.1 AN INTRODUCTION TO SHARE MARKET:

Share market is a broad term embracing a number of
markets in which shares are bought and sold. Share markets
could be classified into two categories, primary markets and
secondary markets. New issues are made available in the
primary markets, shares that are already outstanding and
owned by investors are usually bought and sold through the
secondary markets.

The existence of share market is of advantage to both
issuers and investors. As to their benefit to issuers, share
markets assist business and government in raising funds. In a
society with private ownership of the means of production and
distribution of goods and services, savings of the public
must be directed toward investment in industries where capital
is most productive. Governments must also be able to borrow
funds for public improvements. The market mechanisms make
possible the transfer of funds from surplus to deficit sectors
efficiently and at a low cost. A continuous market for shares
provides a favourable climate for raising capital. Since there
will be a continuous market available after the shares have been

issued, a new offering is more readily salable to investors.
The share market is authorized and hence provides protection
to the investor. Thus the share markets act as a bridge between
the issuers and the investors.

Shares must be listed to be traded on the stock exchange.
The stock exchange lists only those companies' shares which
fulfil certain requirements about broadbasing of ownership
etc. specified by the government. A company should have
atleast 60 percent of the issued capital being   offered for
public subscription. Also, the aggregate market value of
publicly held common shares should be more than a minimum
value and the company should provide the share-holders with
voting right. In addition, the exchange considers the national
interest in a company, the market for its product, its position
in its industry and its relative stability. The company being
listed must agree to submit its earnings statements semi-
annually thereby enabling investors to judge the work of the
company's shares. After the initial listing, companies that
donot maintain standards set by the exchange are delisted.
Thus listing in share market serves as an index of performance
of a company.

Though the companies must meet rather stringent require-
ments for getting their stocks listed, they still want their
shares to be listed in stock exchanges. A company wishing to
procure direct subscriptions for its issue of capital from the

public must avail the services of the members of a recognised stock exchange to act as managers, brokers and under-writers of the issue. But the members cannot act in these capacities without the specific permission from their exchange and while granting such a permission, the exchange lays down conditions which include listing. Listing in a stock exchange has several other advantages to the firm. First, listing improves the liquidity of a share, making it a more attractive investment. In turn this tends to increase the price of the firm's shares because of greater investor demand. Second, by listing its shares, a firm will obtain some publicity benefits. The very act of listing on a national stock exchange will bring the company's name before the public and various announcements,dividends, earnings, and new products will be brought to the public's attention. Exchange listing also facilitates merger activity since prices are readily determined for the shares of the firms in the merger agreement.

Investors also benefit from market mechanics. If investors could not resell shares readily, they would be hesitant to acquire them in the first place, and such reluctance would reduce the quantity of funds available to finance industry and government. Those who own shares must be assured of a fast, fair, orderly and open system of purchase and sale of shares at known prices. This is exactly the purpose what share markets serve.

1.1.1 What is a Share?

Shares are issued by a firm or to be more specific, a limited company in order to raise capital, either for expanding its business or for launching the firm itself. By issueing shares, the firm distributes its ownership among those who purchase its shares. Thus shares represent ownership position. Perhaps the most fundamental right of the share holders is to share the earnings of the firm after all expenses and obligations have been paid, but at the same time, they also run the risk of receiving nothing if the firm's earnings are insufficient to cover all the expenses and obligations. But from a common share holders point of view one of the chief advantages of the limited company form of business is that his liability to creditors is limited - i.e. he xcan lose no more than the purchase price of his shares. A private limited company becomes a public limited company as it issues its shares to the public. If the number of shareholders of a company is more than fifty, it is called a public limited company.

Among the other benefits, a shareholder has the right of voting in selecting the board of directors of the company, right of sharing the assets (after all other types of creditors) of a firm when it is liquidated and the right of purchasing shares of the company in consequent share issues before it is offered to the non-shareholders (preemptive rights) [3].

There are two basic forms of shares: preference and common. In this present work a share is referred to as a common share (Also a share and a stock are used synonimously). A common share is often referred to as the residual ownership claim of the firm, because the holders of common shares are, by law, the last ones in the order of receiving the benefits from the firm. However, whereas other types of financiers to the firm receive a fixed amount of money on what they have credited, the common shareholders enjoy the rest of the earnings how much ever it could be.

1.1.2 Investing in Shares - Pros and Cons:

There are two major advantages in investing in shares: income and capital gains. A shareholder of a firm gets a periodic income in the form of dividends. The percentage of dividend largely depends on the earnings of the firm. The dividend percentage could be as high as double or even triple the rate of interest one gets from banks or other kinds of securities. When a firm's business and earnings grow, the market price of its share will also go up and the shareholder thus enjoys a capital gain as well.

However, there is a large amount of risk associated with investing in shares. If a company incurs loss or if its earnings are not sufficient to xcover other obligations such as interest on bonds and dividends for preferred shares, it

may not pay any dividend on common shares at all. As a result of little or no dividends and a declining business and earnings of a firm, its share price in the market may also go down and hence the share holder suffers a capital loss. At the worst, the firm's shares may not sell in the market at all, as a result of which the shareholder ends up losing all his capital.

Hence, an investor should make up his mind before he invests in shares and must select the firm(s) in which he wants to invest with a careful judgement.

1.2 THE STOCK EXCHANGE:

A stock exchange is a statutory institution where securities may be traded. Corporate securities include debentures (bonds) and shares. Gilt edged securities i.e. fixed interest securities issued by Central Government, State Govts., local authorities, or other statutory bodies are also listed and traded in these exchanges. In India, there are fourteen stock exchanges operating, the largest being the Bombay Stock Exchange (BSE). The other important exchanges are Calcutta, Delhi, Ahmedabad and Madras Stock Exchanges. By the end of year 1984, about 1295 companies had listed their securities at BSE and the number of total securities listed was 2,154. The paid up value of the shares was Rs. 5,814 crores and their market value was Rs. 10,129 crores. The total value of transactions of all the Stock Exchanges of India was Rs. 4,557.81 crores. Normally the markets are open about 20 days a month

and shares worth Rs. 23 crores (approximate) are traded on every business day at BSE. The stock exchanges at Bombay, Calcutta and Delhi have introduced computerized accounting methods for settling the transactions carried out. The BSE is introducing a computerized on the spot price display for quick and easy verification of share prices [2].

1.2.1 Types of Transactions at Stock Exchange:

The securities in which dealings are permitted on the exchange are distinguished as (1) cleared or specified securities, i.e. securities admitted to dealings and placed by the Governing Board of the exchange on the cleared or specified list, and (2) non-cleared or non-specified securities which are not so placed.

The transactions in securities may be of the following types [2].

1. Spot delivery: Delivery of share certificates and payment on the same day as the date of contract or the next day.

2. Hand delivery: Delivery and payment within the date stipulated while entering into the bargain, which time and date shall not be more than 14 days following the date of contract.

3. Special delivery: Delivery and payment within any time exceeding 14 days following the date of

contract as may be stipulated when entering into the bargain and permitted by the exchange Governing Board or the president.

4. Clearing: Clearing and settlement through the clearing house in the manner prescribed by the bye-laws and regulations.

Transactions for spot delivery, hand delivery and special delivery may be made on any securities in which dealings are permitted on the exchange. Transaction for clearing shall be made only in specified securities, and such bargains in any other securities shall be deemed void. Though bargains in specified securities be for any of the above four, these shall be deemed for the current clearing, unless otherwise stated.

Settling Dues:

The clearing house acts as the common agent for clearing contracts between members for delivering and receiving securities and for receiving or making payments for contracts entered into by them. The advantage in doing business for the clearing is that even at the time of settlement the full cost of the shares purchased is not required to be paid, nor is it necessary to tender delivery of shares sold. Only the difference between the purchase or sale price and the making-up price fixed for the purpose of settlement by the Governing Board may be paid or received. The original business can thus be carried forward to the next account.

Since little capital outlay is required for clearing,
a speculator can deal in a much larger number of shares than
if he were to pay for his purchase.

1.2.2. Settlement Procedure:

On a normal working day at Bombay Stock Exchange,
transactions in all categories result in a turnover of about
Rs. 20 crores. The prime requirement for a smooth settlement
is to ensure that members record their transactions. At the
end of each working day, each member submits the details of
all the transactions entered into by him during business
session to the computer centre. The furnished data is entered
into the computer for verification. The computer checks whether
the data reported by one member is matched by the data of
other members. Normally 70-75 percent of the reported transac-
tions match fully. The remaining which do not match could be
in nature of absence of response from the other broker or differer
in either quantity or rate or both. Fully matched transactions
are logged into the computer daily from the beginning of the
settlement period to the last day.

At the end of the settlement period, all the matched
transactions are settled according the regulations of the Stock
Exchange depending on the type of transaction. For all the
shares, the making-up price is fixed and all the transactions
are settled at the making up price and the differences.

1.3 INVESTORS vs. SPECULATORS:

An investment may be stated as"commitment of funds made in the expectation of some positive rate of return."[4] Generally, investment is distinguished from speculation by the time horizon of the investor and often by the risk-return characteristics of the investment. The true investor is interested in a reasonable rate of return, earned on a rather consistent basis along with capital appreciation over a relatively long period of time. He invests after investigating fundamentals of a firm like volume and value of production, sales, earnings and dividends as well as the growth in these factors. However, an investor may sell a scrip shortly after buying if in his opinion, the fundamental factors have changed.

In contrast, the speculator seeks opportunities promising very   large returns, earned rather quickly. He purchases a share because he expects to sell it soon at a higher price. In fact he may take the advantage of the differences in quotation for the same share at two stock exchanges. A speculator may also indulge in switching which involves taking advantage of price differences of shares having the same characteristics. The speculator is less interested in consistent performance than is the investor, and is more interested in abnormal, extremely high rate of return than the normal, more moderate rate. Furthermore, the speculator wants to get these returns

in a short time and then seek better opportunities in other
investment outlets. However a speculator generally takes
more risk in an investment than an investor.

Despite his motivations, the speculator adds to the
market's liquidity and depth, for he is frequently turning
over (changing) his portfolio. Thus, his presence provides
a market for shares (depth) and a wider distribution of
ownership of shares (breadth) and enhances the capital markets.
Also a speculator help even out the price differences in time
and place, minimizing the price deviations from investment
values, making prices reflect future as well as current
events, and causing quotations to be continuous.

1.4 STATEMENT OF PROBLEM:

Before investing in shares, an investor must carefully
select the firms in which he wants to invest. For this, the
investor has to apply the concepts of fundamental and technical
approaches. He also should have knowledge of forecasting
techniques and financial management. After selecting the firms,
he has to apply the concepts of portfolio management for find-
ing a portfolio which is most effective. This is an omenous
task because there are too many uncertainites associated with
the problem variables and the environment as a whole. The
investor may wish to invest his capital either for a long
term or for a short term. Depending on his investment goals,
he has to select the scrips which suit his purpose.

The present work aims at building a Decision Support System for stock market investment. The package developed helps the investor in selecting the scrips and building an effective portfolio which optimizes the benefits and the risk.

CHAPTER II

STOCK EVALUATION: THE BASIC LITERATURE

2.1 AN INTRODUCTION TO STOCK VALUATION:

2.1.1 What Gives Value to a Stock?

Basically, stocks serve three major purposes. Firstly, they provide a vehicle for holding wealth of an individual or of a firm, however meager it may happen to be. Secondly, they are also vehicles for enhancing the wealth. Thirdly, they provide the stock holder a periodic income in the form of dividends. It is these three useful qualities that give stocks value.

2.1.2 Why Should a Stock be Evaluated?

All the stocks may not serve all the three of above stated purposes uniformly. Some stocks may give higher income and some other stocks xcould be more secure. Some stocks may have higher growth in price appreciation whereas others may not. Then, the problem is to determine: which stock or stocks to hold. Which company's stock provides maximum benefits to the share holders. Which stock is most secure. Which stock offers easy liquidity.

Answering these questions is not simple because there are many uncertainities associated with the problem. But it is necessary to have some yard stick to compare the performance of stocks. For the right selection of stocks, one must evaluate the stocks and then select those stocks which provide maximum benefits with least risk.

2.1.3 Possibility of Making Money out of Shares:

The prices of almost all the shares vary constantly depending on numerous factors. An intelligent investor may make profit by exploiting these variations in the share prices. He can buy a share when it sells at a low price and sell the share when its price goes up. It may sound easy to do but in practice, it is extremely difficult to determine (1) which stock to buy, (2) when to buy, (3) which stock to sell and, (4) when to sell. Yet, a careful investor can make profit out of the share market by selecting a scrip by evaluating its potential to grow by studying the company's performance and determining the time to buy or sell by a careful study of market moods and the movements of the price.

2.2 STOCK VALUATION:

There are two most influential approaches by which the valuation of stocks is done. These two approaches differ in their basic concepts in valuating the stock. They are:

1. Fundamental Approach (classical approach)

2. Technical Approach.

2.2.1 Fundamental Appro. ch vs. Technical Approach:

The fundamental approach to stock valuation stresses
the influence of basic earnings and risk of a firm on the
market price of its shares. Technical approach concentrates
on the patterns of stock market prices, both in particular
cases and in general, as an indication of the future direction
of stock prices. To elucidate, the fundamental analysis studies
the reasons or factors which may affect the stock price and
predicts the future price depending upon the changes in these
factors. A value is placed on a share based on the price,
those shares of comparable class are selling for. There could
be differences between stock prices and stock values at a
given point of time and the fundamental methods make profit
out of these differences. The technical methods on the other
hand, seek out the strengths and weaknesses of various shares
or of share market as a whole as indicated by past price
behaviour. The technical methods decide whether to buy or
sell and when to buy or when to sell. This approach does not
look into the reasons of the changes in the share price at all.
This approach tries to forecast future share price movement
based on past records of price-movements.

For a successful investment, one should consider both the methods and try to maximize the benefits and minimize the risk involved.

2.3 FUNDAMENTAL ANALYSIS (CLASSICAL APPROACH :

This is the oldest and most respected approach for analysis of share values. The fundamental approach centres around the axiom, share prices are slaves of earning power, over a period of time share prices raise in response to increase in earnings and fall with decrease in earnings [7].

2.3.1 Important Factors to Study:

A study of earning power is the backbone of the fundamental method of security appraisal. A raising long term trend in earnings is an almost certain due to a stock that will advance in the market. The general growth in sales and assets is also an important factor influencing share price. Among the other basic factors, balance sheet positions (current position and debt structure), profit margins, percentage earnings on invested capital and net worth. Cash flow, and dividend payments are important. Further a review of current and past annual reports may prove revealing, observation of changes in sales, expenditure in research and development of new products will round out the valuation procedure.

2.3.2 Estimating Earning Power of a Specific Scrip:

The earning power may be defined as the average amount per share that the company as it is presently constituted would probably derive under various sets of circumstances in the economy and its industry.[7].

In cases where considerable stability in earning power is evident, current year earning may represent the best estimate of normative earning power. The reason is that the such earnings do represent the most tangible evidence of the capacity of the company as it is currently constituted. And if dynamic exogenic events are likely to have only a marginal impact on the company's earnings performance, then there is no need to use a series of prior earnings realized under various types of business conditions.

Companies that evidence both reasonably favorable growth potential and also high volatility in their per share earnings offer the greatest problems in estimating normative earning power. On the one hand, the current performance may be heavily influenced by prevailing economic conditions that may not be representative of average probable conditions in future. On the other hand an averaging of prior results under various levels of economic activity necessarily include periods when the company had not reached its current productive and earning capacity given the strong growth presumption. In these cases,

the least-squares trend regression result might provide the
best indication of normative earning power, as this technique
should incorporate the growth feature and also average out
the cyclical factor. However, in these cases the confidence
in any given estimate of earning power might be low. A range
estimation on the basis of favorable industry conditions on the
one hand and unfavorable conditions on the other might be useful
in some of these situations.

2.3.3 Some Approaches to Selection of Scrips:

This section discusses various fundamental methods of
evaluating shares, so that a subset may be selected.

Ratio of Price to Earnings:

With a reasonable estimate of earning power (usually as
the EPS), we can evaluate the relative attractiveness of the
price that must be paid for each rupee of earning power.
Comparisons can be made within a group or class of scrips, e.g.,
within an industry, or within a group of equivalent risk scrips.
In addition a comparison with the price earning ratio of the
general stock market might also be appropriate.

To evaluate a particular scrip, we take all firms in a
group (e.g. in some industry, or with same risk, etc.) and take
the average of price earning ratios of these firms. Multiply
this average to the earnings of the firm whose security is
being evaluated.

This approach assumes that the market is in its appraisal i.e. that the market price is true indication of firm of like kind and quality.

For example, suppose average earnings for a group of firms are Rs. 5.00 and on average firms are selling shares about 12 times this expected earnings. Now this is considered to be the proper price (Rs. 60.00).

If the firm under consideration is selling at lower price say Rs. 50.00 without any special reason, then these shares should be bought (because it will reach Rs. 60.00 eventually). Similarly, if the firm is selling higher than Rs. 60.00 with no reason specially, it is anamolous and hence it should sold right now if already holding or it should not be bought.

The investor in his judgement, may adjust the P/E ratio of a scrip if he thinks that market appraisal is not a fair one for the scrip. This is sometimes called do it yourself approach.

Based on these analyses a subset of desirable scrips may be chosen.

2.3.4 Earnings Model:

This model expresses the market price of the share of a firm as the present value of the future stream of earnings of the firm. The rationale in its use is that if this theoretical

market price is much higher than actual price, the share is worth buying.

Suppose,

E - is the earnings per share of the firm currently.

K - is the rate at which earnings are discounted.

then, price can be found by the following equation.

$$\text{Price} \quad P \quad = \quad \frac{E}{(1+K)} + \frac{E}{(1+K)^2} + \ldots, + \frac{E}{(1+K)^n} \qquad (1)$$

$$= \quad \frac{E}{K}, \quad \text{when n is sufficiently large.}$$

In developing the equation three assumptions were made:

(i)   The discount rate (K) applied to the future earnings of the firm will remain constant in future.

(ii)   Company's earnings will remain constant in future.

(iii)   The share holders will receive the earnings that are generated.

But all the three assumptions are often violated.

2.3.5 Dividend Model:

This model defines the price of the share as the present value of future stream of dividends where dividends are expected to grow at a steady rate of g percent per annum and are discounted at K percent,

$$P \quad = \quad \frac{D}{(1+K)} + \frac{D(1+g)}{(1+K)^2} + \frac{D(1+g)^2}{(1+K)^3} + \ldots + \frac{D(1+g)^{n-1}}{(1+K)^{n-1}}$$

Provided that K > g and n is sufficiently large, the above simplifies to,

$$P = \frac{D}{K - g}$$

Example:

Suppose D = Rs. 2.00 for a particular scrip,

g = 0.033 per annum and

K = 10 percent

then,

$$P = \frac{2}{(0.1) - 0.033)} = Rs. 30.30$$

if g raises to 6 percent from 3.3 percent, the expected price of share will be Rs. 50.00. Similarly if divided increases to Rs. 2.50, while K and g remaining constant the expected share price would be Rs. 62.50.

2.3.6 Estimating Relative Returns:

Based on the assumptions that the earning multiples (P/E) might ultimately return to their average levels and that the indicated growth rates would continue, a quantitative estimate of the potential appreciation may be derived by using the following equation,

$$AF = \frac{En\ Mn}{P}$$

where,

n — Holding period (time horizon of estimation)

En — Appreciation return factor

Mn - Earning multiple in n-th year

P - Prevailing price at time of analysis.

Both En and Mn are estimated by extrapolating the past earnings
of the firm.

Suppose under the above indicated conditions, two firms
have appreciation return factors AF1 and AF2 and AF1 > AF2.
Then the company having higher AF will give higher a compound
appreciation return than the firm with lower AF. But it would
be questionable to place much confidence in these absolute
estimates where there is some uncertainity associated with the
values used in the formula and the validity of assumptions.
The analysis merely indicates the relative return outlook, if
both companies continue to maintain the growth rates demons-
trated in the past and also show a roughly equal tendency to
move toward their past multiple norm, then the firm with
higher AF will show a greater annual appreciation of return.

2.3.7 Use of   Growth Yields:

Although estimates of relative appreciation potentials,
adjusted for quality differentials if they appear significant,
often provide a reasonable approximation of the comparative
attractiveness of one or several common stocks, for some port-
folio decisions, the concept of growth yields may be useful.
The growth yield can be defined as the yield that equates the
present value of a raising dividend stream with the present

market price. The assumptions on which the growth yield computations are based are:

1. Estimated growth rate in dividends
2. Expected duration of the growth rate in years
3. Constant level of dividends after growth has been completed.

The concept is based on the principle that the dividend yield can also be considered as a discount rate applied to the future stream of dividend payments.

Drawback.

The major drawback to the use of growth yields, besides the uncertainities involved in the dividend projections, is that they assume an indifference to the timing of the anticipated income receipts.

There is a wide spread notion that the fundamental approach is inadequate because the information necessary to make decisions is much too slow in forthcoming and is it difficult to evaluate once it is available. In other words, by the time the information necessary to make a fundamental analysis is available, much of the advance or decline in market price will have taken place. And as a result, a maximum profit from buying and selling stocks is not realized. Though this notion is true, the fundamental analysis proves its utility in long term investments.

2.4 TECHNICAL METHODS:

Much of the short term trading is conducted on the basis of purely technical market analysis. This may be defined as the collection and interpretation of various data pertaining to actual transactions in the stock market with the objective of descerning predictive probabilities of subsequent price movements. The following are some of the tools used by market analysts:

1.   Price patterns of stocks or market indexes.

2.   History of trading volume and changes there in.

3.   Ratio of number of stocks advancing to those declining.

4.   Action of low priced stocks compared to high priced stocks.

5.   Pattern of insider purchase and sales.

6.   Pattern of odd-lot purchases and sales.

The hypothesis of technical market analysis strategy may be set forth as follows:

1.   Short term price fluctuations offer maximum potentials for profits.

2.   These fluctuations are due to changes in supply and demand, which inturn are governed by numerous factors both rational and emotional.

3.   The dynamics of changing patterns in supply and demand can be detected by pertinent market data in some combination or another as per above list.

4.   Insights revealed by technical analysis of changing
conditions tend to persist, if these insights are rapidly
identified, subsequent movements of prices will be sufficient
to enable traders to acquire and sell stocks on the average
at significant profits.

Technical analysis concentrates on the pattern of
stock market prices as an indication of the future direction
of stock prices. The technical analysis uses charts of previous
price movements and other data from which an indication of
future price movements can be obtained. The essense of tech-
nical analysis is to seek out the strengths and weaknesses of
various securities, or of the market, as indicated by past
price behaviour. The technician seeks to take advantage of any
changes in stock market prices, regardless of the reason for
the changes. He buys under the conditions that are technically
strong and sells on the basis of technical weakness. Some inves-
tors take into account fundamental factors as well instead of
depending on the technical analysis extensively.

The Basic Input Data:
        The basic input data for technical analysis of overall
stock market prices are a stock price average or stock index
and data relating to volume (i.e. number of shares traded).

2.4.1   The Dow Theory:

The most popular and doubtless most widely-known of
the technical approaches to overall securities markets is the
Dow Theory, which essentially attempts to anticipate market-
price movements by seeking turning points.

(a)   The Basic Nature of the Dow Theory:

The connection between changes in business activity and
stock market prices is to be found in the underlying assump-
tion that the averages tend to discount (i.e., take into account,
evaluate) every-thing foreseeable on the business horizon. Since
stock market prices are determined by earnings per share and
earnings per share are in turn determined by business activity,
it was not long before an index of stock market prices, such
as Dow's averages, was being used in attempts to predict the
future movement of those prices. The feeling was that the
consensus of the market, as reflected in market-price movements,
tells all about the future of these movements.   Thus the funda-
mental elements of this theory center on movements in market
prices, in fact, on three distinct sets of movements. First
are the primary movements which indicate long-term trends.
Second, there are the intermediate term movements. These are
usually easily identifiable movements within bull and bear
markets, and at least two or three of these, perhaps more,
ordinarily take place in either a bull or a bear market. The

third set of basic movements consist of the daily movements -
that is, day to day fluctuations in market prices. These last
are considered somewhat unimportant.

(b) The Mechanics of the Dow Theory:

The mechanics of the Dow Theory operate as follows:
First, to obtain a valid record of the cyclical movements in
stock prices, the high, low, and closing prices of theindustrial
and rail averages are plotted weekly. According to Dow Theory,
a primary movement in these averages either upward or downward,
once established, will continue in the same direction. A basic
primary movement upward, however, is often interrupted by
secondary reactions (movements downward). It is from both
primary trends are derived.

Line Formations:

A confirmation of a primary trend may be made as the
averages are making a line, which indicates that fluctuations
in the average are within a very narrow range for a period of
several weeks. The precise range of the line is immaterial,
it is merely sufficient that the upper and lower bounds be
identifiable. Figure illustrates such a line formation. Accord-
ing to technicians, such a range of price movements represents
some sort of equilibrium, a position from which there is no
tendency to change and in which buying and seeling just about
equal each other. The development of the line between points

A and B in figure indicates that the average is about to move
out of the bounded range, although nothing can be inferred at
this point regarding the direction in which it will move. The
basic line formation runs from point A to point B. At point B,
a break-out occurs on the upside of the line. This is taken as
a bullish signal, and will persist until a reversal signal is
made. In order for a confirmation to be made, a break-out in
a line formation is necessary.

Peaks and Troughs:

The second method by which confirmation of a primary
trend may be made involves a number of steps. Essentially,
this method arrives at a confirmation by establishing that,
in the case of a potential upward trend, an increase in a
secondary (intermediate-term) movement has exceeded previous
highs, and that each successive secondary retrenchment has
reached a higher point than the previous low (Confirming a
primary trend downward involves establishing the same points,
but in a negative direction - i.e., primary and secondary move-
ments must set new lows). Whenever one average reaches a new
high and is followed by a new high in the other average, confir-
mation of a primary trend is said to have been made. A confir-
mation that takes place as the averages are rising signals a
primary bull market, which should continue until either average
shows an opposite signal. A downward movement in the industrial
average does not infer a bear market, however, until it is

confirmed by downward movements in the rail average. If there
are no confirmations, then the preliminary bearish signals of
the industrials are meaningless.

2.4.2 Other Overall Technical Indicators:

(a) The Confidence Index:

Another index designed to gauge the change in direction
of the securities market is the Confidence Index. According to
the theory underlying this index, when the ratio is high, confi-
dence of investors is likewise high, as reflected by their
purchase of relatively more of the lower-grade securities. When
investors buy relatively more of the higher-grade securities,
this is taken as an indication that confidence is low, and is
reflected in a low ratio. In other words, the Confidence Index
presumably indicates the direction in which important capital
is going. Confidence Index is a reasonably accurate indicator
of either a move away from a move to risky investments, and
such moves show up in the bond markets first. In short the
difference in yields indicates the tenor of the bond market,
a condition that will eventually pervade stock markets.

(b) Odd-Lot Measures.

One measure of the overall Technical condition of the
market is the outgrowth of a theory, popularized by Garfield
Drew, suggesting that changes in odd-lot transactions portend
significant market trends. This is the odd-lot index, which

is based on a ten-day average of the volume of odd-lot transactions, and which contrasts odd-lot buying with odd-lot selling. If odd-lotters are buying on net (i.e., if there are more odd-lot purchases than odd-lot sales), this is seen as an indication that the small guy is coming in and that, as a consequence, the time has come for the smart money to sell out. A basic assumption of this theory is that the small buyer—one who purchases less than 100 shares at times – is somewhat ill-informed and that his move to buy is therefore a reliable signal for more substantial investors to get out. Thus, when odd-lotters are selling on net (when there are more odd-lot sales than odd-lot purchases), it is time to buy in. Consequently, a relative increase in net buying is considered bearish, a relative increase in net selling bullish.

Also underlying the concept of odd-lot trades as a valid technical indicator is the idea that the small, inexperienced, and ill-informed investor typically enters the market at the tail xend of an increase in stock market activity, because then his level of income is high, he has excess money to spend, and usually, so the argument goes, a large, or significant part of it will flow into the stock market. As a result, the small buyer enters bull markets at the top – he is buying on net, the signal for smart money to get out of stocks. When the odd-lotter, on the other hand, is selling on net, the presumption that he needs money and according to the adherents of this theory, this may consequently be a good time to buy stocks.

(c)   The Advance-Decline Ratio:

Another overall technical indicator is the so-called
breadth of the market, which is determined by taking into
account not only the total number of issues traded but the
number of advances and declines as well. When the index
relates advances directly to declines, the relevant figure is
called an advance-decline ratio. Some technicians consider
this index as a guide to the internal strength of the market.
An increase in the ratio is taken to be bullish, a decrease
bearish. That is, when advances persistently out number dec-
lines, a bullish condition is said to exist, and vice versa.

(d)   The Breadth Index:

The breadth index is a variant of the advance-decline
ratio, it, too, relates the number of securities that have
advanced to the number that have declined. The actual computa-
tion of the breadth index is not difficult, although it is
different from the advance-decline ratio. One merely takes the
difference between the number of advances and the number of
declines every week and divides this figure by the number of
shares that have not changed in price. For example, if in a
given week 900 shares advanced, only 300 shares declined, and
200 were unchanged, then we divide the difference between the
two, 600, by the unchanged figure, 200, and arrive at a breadth
index of 3. Each week, the figure for that week is added to the

previous week's figure. (If more securities declined than advanced, the figure is subtracted). These data are then plotted to establish the pattern of movement of advances and declines.

The ultimate purpose of the breadth index is to indicate when there is either confirmation or lack of confirmation of the important peaks in the averages (such as the Dow Jones average).

(e)   Short Interest:

Still another overall technical indicator is the amount of short interest, by which is meant the total volume of short sales that have been made and are recorded each month by the Securities and Exchange Commission. Increasing short-selling is viewed as a sign of general market weakness and short-covering, as evidenced by decreasing short positions, as a sign of strength. An established large short interest, on the other hand, is considered a sign of strength, since the covers (buying) are yet to come, whereas an established slight short interest is considered a sign of weakness (more short sales are to come). There is a serious limitation to viewing short interest as an overall technical indicator, for short interest only constitutes about 4 percent of the market sales, although this figure may be much higher for any given security.

(f) New Highs of Low Priced Stocks:

An overall technical indicator of some interest is one
which measures the number of new highs obtained by low-priced
stocks. The presumption underlying the validity of this index
is that an increase in the number of persons buying low-priced
stocks signals deterioration in the quality of a bull market.
Thus the purpose of this index, technicians argue, is to indi-
cate that more and more attention is being focused on highly
speculative, low priced issues which, they presume, are pur-
chased by the less-sophisticated general public.

(g) The Market and the News:

Yet another over-all technical market indicator is what
one judges to be the character of the market's reaction to
various new events. It is taken as a sign of weakness if the
market does not react favourably to good news. Other techni-
cians, especially those who maintain that the market tends to
discount any news that may be on the horizon, do not place much
faith in this particular indicator.

(h) Seasonal Considerations.

It is often suggested that there are perceptible sea-
sonal movements in the market. The evidence for this position
is not overwhelming by any means. One of the chief seasonal
aspects to the market is the predictable year and increase in
selling for tax purposes, which is done to realize either

losses or gains. Such selling usually implies that buying
will take place shortly after New Year's.

2.4.3   The Role of Volume:

Volume is often considered to be an extremely important
consideration in the technical analysis of a particular security.
Increases in volume on rallies argur well for further increases.
On declines, increases in volume indicate further declines. The
reverse of these is also true – that is, volume decreases indi-
cate the slackening of a trend either upward or downward.

Also, heavy volume at the end of a considerable move-
ment in prices is believed to indicate a turning point in
prices.

Volume is viewed in still another way. Even if the
market tends to be rising, volume tending to ease off when a
security is experiencing a second reaction is a good sign,
technicians argue, because it indicates that the supply of the
security is tending to fall off as lower prices are reached,
which in turn indicates that owners are unwilling to sell. In
a genuinely bearish situation, volume is supposed to increase
as prices decline, indicating that supply is increasing. This
increase in supply is prompted by the desire of share holders
to sell out, an act presumably motivated by pessimism. This is
essentially a technical weakness. If volume drops off on tem-
porary rallies, the market is considered still weak because no
large amount of buying has reached the market.

2.5 RANDOM WALK HYPOTHESIS:

According to this hypothesis, the direction of the change in the price of a security is random and that past price changes are no clue to future price changes. The reason past price movements are not a guide to future movements, is that the stock market is constantly in equilibrium. All the available information about both macro-economic and corporate variable is reflected with the existing price. The movement in prices about this equilibrium will be random from trade to trade and from day to day. If developments suddenly occur that indicate a change in a firms prospects, this information immediately becomes known to all. A new equilibrium price is immediately established and once again, only random changes in prices will take place about this level.

But in practice, the assumptions made for this hypothesis will never be fulfilled and hence this hypothesis is impractical.

CHAPTER III

DESIGN OF DECISION SUPPORT SYSTEM

This chapter outlines the methodology by which the DSS has been designed.

3.1 AN INTRODUCTION TO DECISION SUPPORT SYSTEMS:

A Decision Support System (DSS) can be defined as a coherent system of computer-based technology (hardware, software and supporting documentation) used by decision-makers as an aid to their decision in semi-structured decision tasks. A task is unstructured when: (1) objectives are ambiguous and non operational, or objectives are relatively operational but numerous and conflicting, (2) It is difficult to determine the cause (after the fact) of changes in decision outcomes and to predict (in advance) the effect on decision outcomes of the actions taken by the decision maker and (3) It is uncertain what action taken by the decision maker might affect decision outcomes [8].

3.1.1 The Use of Computers in Decision Making:

This can be described in terms of various types of decisions. The decisions can be classified as [8]:

Management control decisions related to assuring effectiveness in acquisition and use of resources.

Strategic Planning decisions related to:

1. Setting policies, choosing objectives and selecting resources.

2. Operational control: decisions related to assuring effectiveness in performing operations.

3. Operational performance. decisions that are made while performing the operations.

Decisions could also be classified as structured (Programmable) or unstructured (non-programmable) depending on whether the decision-making process can be described in detail before the decision is made. A decision may be unstructured as a result of novelty, time constraints, lack of knowledge, large search space, need for non-quantifiable data, etc.

Most existing computer support for decision making is for structured decisions, some progress has been made in supporting semi-structured decisions and almost no computer support is used for unstructured decisions.

3.1.2 Characteristics of a DSS:

(a) Decision Making:

1. A DSS should support multiple processes.

2. DSS should be flexible to support different types of decisions.

(b) Decision Makers:

1.   A DSS should provide familiar representations such
      as charts and graphs to assist in conceptualization.

2.   Decision makers perform Intelligence, Design and Choise
      activities while making decisions, so a DSS should
      provide options which support these activities.

3.   A DSS should provide memory aids which help carry out
      the decision making process.

4.   A DSS should help decision makers work in their own
      idiosyncratic ways because decision makers exhibit
      a variety of skills, styles and knowledge.

5.   A DSS should provide control aids which help decision
      makers exercise direct, personal control.

3.2 OBJECTIVES:

      The present work aims at building a DSS for share
market investment. The main objective of the work is to
develop an interactive package for assisting the investor in
the process of decision making regarding the stock market
investment which involves selection of firms to invest in,
determination of proper time to buy the shares and for build-
ing a portfolio which consists of the selected scrips. The
system should be user friendly and the user should have the
control over the mechanism of the package. At one extreme,
the users should be able to make his own selection of firms

and build a portfolio, using the package just as a tool for
calculating various factors like percentage growths in sales
and earnings, P/E ratios and soon so forth, for giving graphs
of these characteristics and for providing the data he requires.
On the other extreme, the user should be able to obtain an
effective portfolio by treating the package as a mere black-
box and leaving all the decision making to the package. The
package should also provide facilities for up-dating the data
base which consists of the data pertaining to various firms.

The following sections describe how the DSS has been
designed to suit the above mentioned objectives.

3.3 DSS FRAMEWORK:

The framework of DSS is intended to help provide the
user, all the features of DSS mentioned in Section 3.1.2. how-
ever, using the framework one cannot expect to replace manual
support with automated support.

3.3.1 Decision Makers Use and Proposed DSS Components:

Decision Makers' Use	DSS Provides
1. Conceptualization	1. Representations
- The growth of an industry or a firm	- A graph of past performance in terms of sales and earnings.
- Portfolio constituents	- A list of past sales and earnings.
	- A list of performance ratios.
	- A Pie Chart of percentages of investment in each firm and industry.

Decision Makers' Use	DSS Provides
2. Different decision making processes and decision types, all allowing activities for intelligence, judgement, and choice.	2. Operations for intelligence, judgement and choice. - Control aids to control the mechanism.
3. Memory Aids	3. The database - Extracted data on firms and industries - Views of firms' or industries' data - DSS messages
4. A variety of styles, skills, and knowledge applied via direct personal control	4. Aids to control - Menu systems - Help systems - DSS defaults or procedures

3.4 DECISION MAKING PROCESS:

The process of decision making differs depending on the user's knowledge, style and the purpose of investment. The user may have good understanding of stock market and a sound knowledge of share evaluation techniques, financial management, and portfolio theory or he may have some knowledge of one or two of the above or he may even be having no idea of what a portfolio is. The user may be aggressive in investing i.e., he may wish to take more risk in investing expecting a greater profit or he may be defensive. The user may use the DSS for decision making for long term investment or for speculation. The DSS is designed to support the decision making process of all the kinds of users and their goals.

3.5 REPRESENTATIONS.

An activity in a decision-making process takes place in the context of some conceptualization of the information used in the activity. The conceptualization may be a chart, a picture, a few numbers, a graph, an equation etc. The conceptualization may be mental but in most cases it is physically represented. A physical representation is particularly important when the decision maker wants to communicate some aspect of the decision to another person. Representations provide a context in which users can interpret DSS outputs and invoke DSS operations.

In the present work, various representations have been used to help the user in interpreting the data pertaining to industries, firms and the portfolio.

Line Graphs:

In selecting an industry or a firm to invest in, especially for long term investment, one has to study the potential of an industry or of a firm for growth in sales and earnings. In order to study the growth history of sales (or earnings) of a firm a graph of sales (earnings) with time on one axis and sales (earnings) on the other would be more effective than simply showing the raw figures. The DSS has been designed so as to give the graph of past data during the process of selecting the industries and firms.

Lists and Figures:

The user may be interested in knowing various key
factors relating to a firm such as compound growth rates of
sales and earnings, performance ratios like sales turnover
and profit margins, debt ratios, dividend and its compound
growth rate, yield etc. for making decisions. For this purpose,
the package providesx him with these factors as and when he
requires them in the form of tables.

Pie Charts:

After building the portfolio, it can be presented in the
form of a table consisting of various scrips constituting the
port folio and the percentage investment in each of them. But
a pie chart instead of a table would be more understandable
and picturesque. Hence the packagex gives the portfolio both
in the form of a table and a pie chart. It also gives the
percentage investment in each industry in another pie chart.

3.6 MEMORY AIDS - THE DATABASE:

In order to support: the representations and the opera-
tions, a memory aid is necessary. DSS uses a database consisting
of past and present data related to various firms in the stock
market. The structure and description of the database will be
discussed in section 4.4. An extracted database consisting
of data pertaining to various industries is also maintained
for quick access of the industries' data. Finally, a set of

files containing the explanations of the menu options and
the definitions of important terminology is also maintained
in order to help the user during the process of decision
making.

3.7 CONTROL AIDS:

The represent tions, operations, and memories of a DSS
are intended to support a variety of decision making processes
and a variety of types of decisions. The DSS control aids are
intended to help decision makers use representations, operations
and memories to synthesize a decision making process based on
their individual skills, styles, and knowledge. The control
aids may be crucial to the success of the DSS because they help
the decision maker direct the use of DSS and because they must
allow the decision maker to acquire the new skills, styles, and
knowledge needed to make effective use of DSS.

The D S S has been developed with control aids
as menus and function keys for operation selection, the standard
conventions for user-system interactions which are enforced
across representations and operations, andx use of representa-
tions as the context for operation selection. The package also
designed to include aids to support helping and explanations
of terminology used. These help the decision maker learn how
to control the DSS.

CHAPTER   IV

DEVELOPMENT OF THE DSS

This chapter discusses the design of the Decision
Support System. The first three sections of this chapter
describe the approach for analysing the shares and in the
remaining sections, the details of the DSS are discussed.

In the context of the large number of scrips being
traded, and their changing performances, it is difficult
for an investor to make investment decisions. A Decision
Support System for the investors is intended to help the
investor in a manner that vastly speeds up his decision
process. It is also intended to make his decision process
more systematic without adding too much strain.

4.1 METHODOLOGY OF SELECTING SHARES FOR INVESTMENT:

Before investing in a firm's shares, one should evaluate
the firm's performance. There are two major methodologies for
evaluating shares. The fundamental approach is based on the
study of past performance of the firms while in technical
analysis day to day movement and the patterns of share prices
are studied. Thus the present DSS branches into two major
sections: The fundamental analysis and the technical analysis.

Depending on the users choice, the DSS performs either or both of the analyses to assist the user in the selection of right investments. During the selection procedure, the user should interact with the system and give his options and decisions for an effective selection of firms. Once the user selects firms to invest in, the system takes the total amount he wishes to invest in the portfolio and the return he expects on his investment, and constructs the portfolio such that the risk for the given income is minimized.

4.2 FUNDAMENTAL ANALYSIS:

4.2.1 Classification of Stocks:

(i) The necessity: There are more than three thousand stocks traded in the stock exchanges in India. It is, therefore, impossible to examine the entire stock list for everyone to find out the potential stocks as it takes enormous amount of effort as well as time. Hence, it is necessary to aggregate these stocks into a manageable number of groups, thus narrowing down the possibilities for critical analysis.

(ii) Classification: All the stocks in the market have been classified into various groups on the basis of the industry to which the firm belongs to. The industrial classification is most widely used and the information about any industry is readily available because, most of the financial services, journals etc. follow the same classification.

Within the entire cross-section of industrial groups,
there may be leaders and laggers, but one industrial group
as a whole generally takes the lead. Shares could also be
classified as low priced, growing and high priced shares.
But this classification is often misleading because, one can
make profit out of a low priced share by using the variations
in the share or one may not be able to make any profit out
of a high priced share. Also, identifying the growth stocks
is oftenx very difficult. The industrial classification is
very effective because, firms within an industry share a num-
ber of common characteristics which affect their share prices.
Like all the firms in an economy are affected by changes in
fiscal policy or the level of interest rates, firms in same
industry are related in terms of demand for their product(s),
fixed and variable factors of production, barriers to entry
and other factors which influence the determinants of value.
For this reason, fundamental security analysis focuses on the
notion that evaluation procedures proceed sequentially from
economy to the industry and then to the firm in that order[6]

4.2.2 Industry Analysis and Selection:

For selecting the industries, each industry in the
database has been considered and analysed. for finding out its
potential for growth and its weaknesses. The ultimate objec-
tive is to estimate the industry's performance in the future
and this prediction is based largely upon how the industry

performed in the past. Growth is taken as the primary measure
of performance and it includes both growth in the sales and
growth in the earnings of the industry. The sales data of
an industry is obtained by taking the sum of all the firms'
sales in the industry and earnings of an industry is obtained
by taking the average of earnings per share for all the firms
in the industry. For eliminating the scale effects, the sales
figures of each firm have been normalized such that the actual
growth is reflected in the data. The absolute sales figures of
an industry in the database may not be meaningful.

(i) Growth: The growth of an industry is mainly characterised
by the growth in the sales and earnings and most of the other
factors are reflected in these two characteristics. An industry's
growth is obtained from its past sales and earnings figures. The
data is first smoothened by taking three year moving averages.
(This period can be changed if the user wishes). Then the
growth is calculated by taking the average of the growths in
each period. Growth in earnings is calculated in a similar
manner and these two are compared to the minimum growth require-
ments set by the user. If the industry's growth is more than
the minimum required growth, the industry is considered for
further analysis otherwise, the user is asked to give his
decision after studying the graphs of sales and earnings,
plotted against time.

(ii) Earnings: When the goal of investment is income rather than the capital appreciation, the user is more concerned about the industry's current earning power. Hence the current earnings of the industry is compared to the minimum allowable earnings set by the user. This process cuts off the industries whose performance is not upto the required level.

After the primary selection of industries is done, the user is given the option of cutting off the firms on the basis of sales growth or earnings growth, current earnings, average dividend rate or any combination of these measures. After selecting the industries, the user is given the option of adding (or deleting) any firms to (from) the selection list. This gives the scope of considering many other factors which are not quantifiable for selecting the industries as well as takes care of the users personal preferences.

When the user wishes to speculate, the industry analysis is not done because, he is not very much interested in a consistent performance of industries.

4.2.3 Analysis of Firms:

After selecting the industries, only those firms which are in the selected industries are analysed. The analysis of growth is done in the same manner as for industries but the growths in sales and earnings and the current earnings are compared to the industry's average rather than to the minimum

allowable values. For selecting a firm, the condition is that the firm should not have a lesser growth or earnings than its industry average. However, the user may consider any firm which does not satisfy this requirement, if he feels that the firm is worth analysing. The user can study the plots of past sales, earnings or prices if he wishes to. Also, the user can consider any firm which need not necessarily belong to one of the selected industries, when the firm's performance is satisfactory or it has the potential for growth.

The price earnings ratio for all the selected firms and industries are calculated and all the firms which have P to E ratio less than that of the industry are selected. If a firm's price earnings ratio is more than the industry average with no specific reason, purchasing its shares is not advisable because the share price eventually comes down such that the P to E ratio becomes same as that of the industry. The user will be given the options of cutting off the firms on the basis of growth, earnings, yield and P to E ratio. He can cut off firms based on any one or more of these factors.

Once the firms are selected, the user may wish to study various ratios of some firms. The system provides the user with the ratios of any firm he wishes to study. The user can delete any firm from the selection list if the ratio analysis proves the firm not worthy for investing in.

When the user wishes to speculate, all the firms are considered, and their expected price is calculated using dividend models. Then the actual price is compared to the expected price and any possibilities for making profit are explored.

4.2.4 Portfolio Construction:

Once the user selects the firms to invest, the problem is to determine how much to invest in each of these firms. Which mix of the shares would minimize the risk for an expected rate of return. What would be the rate of return. What would be the risk.

In order to serve these purposes, the DSS provides for constructing the portfolio based on Markowitz's well known model of the mean-variance [15]. The expected income on a share is determined by extrapolating the income in each year in the past and risk is determined by mean square error. The problem can be formulated into a quadratic optimization program. The package gives the user a series of efficient portfolio distributions i.e. minimizing the risk for a given expected return or maximizing the return for a given risk. The user can give his expected income to the user and get the portfolio which minimizes the risk on return. The user can also insert a fixed income security or bond in the portfolio if he wishes to.

4.3   TECHNICAL ANALYSIS:

If the user wishes to perform technical analysis of share the system branches to technical analysis part of the package. In the technical analysis, the user can select the firm he wants to analyse and the period of analysis. Depending on the users option, the firm's weekly, monthly or yearly price is plotted. The system can not identify any formations in the price graph and hence the user himself has to identify the formations and he can get the information about these formations from the system. For assisting the user in identification of these formations, the system helps the user in two ways. Firstly, it displays templates of four important formations and the user can move these templates on to the price graph and match the graph's shape with the template. However, the user can not change the shape and size of these templates. For an erudite user, the system provides the facility of drawing lines on the price graph. The user can select any two points on the screen and the system draws a line between these two points. The user can identify any formation by drawing few lines on the price graph and then he can seek the information about the formation for making a decision.

4.4   FILES AND THEIR STRUCTURE:

The package handles a large amount of data pertaining to various firms and industries. It is necessary to add new

data to the existing data and modify the existing data. Also, the package provides the user with explanations of various menus and terms used in the form of help . All this information is to be stored in such a manner that it occupies least possible memory space and can be accessed quickly. In order to serve these purposes, the package makes use of various files to store the data and other information. These are

1. IND.DAT

2. FIRM.DAT

3. FIRM.NOW, and 4. TEXT FILES

The files used, their structure (fields) and the updates possible, and other programming features are described below.

4.4.1 IND.DAT:

KEY	YEAR	DESCRIPTION	SALES	EARNINGS	NO.OF FIRMS

This file stores the data of various industries.

(i) KEY: A key is given for each industry in the database. All the firms within an industry will bear this key. This easens the identification of the firms in an industry.

(ii) YEAR: Year (last two digits) to which the data belongs.

(iii) DESCRIPTION: The name of the industry.

(iv) SALES: This is the average of all the firms' sales within an industry.

(v) EARNINGS: This is the average of all the firms' earnings within an industry.

(vi) NO. OF FIRMS: Number of firms representing an industry in the database.

The file is sequential.

UPDATING:

1.   When the user adds a new firm's data to the file FIRM.DAT (to be discussed in the next section), the data of the industry to which the new firm belongs is automatically updated accordingly.

2.   A new industry could be added if necessary. However, an industry must consist atleast of one firm before the package is run for decision making.

3.   A new years data is added to an industry's data when the years data is added to the firms' data   within the industry.

4.4.2   FIRM.DAT:

This file contains the data of various firms.

KEY YEAR DESCRIPTION SALES EARNINGS DIVIDEND PRICE

(i) KEY: This is the key of the industry to which the firm belongs to.

(ii) YEAR: Year to which the data (sales, earnings, dividends) belongs to.

(iii) DESCRIPTION: Name of the firm.

(iv) SALES: Net sales of the firm during the year in thousands of rupees.

(v) EARNINGS: Earnings per shares of the firm during the year (as percentage of share value).

(vi) DIVIDEND: Dividend announced during the year (as percentage of share value).

(v) PRICE: Closing price of the accounting period during the year.

The file is sequential.

UPDATING:

1. A new year's data can be added to an existing firm's data.

2. A new firm can be added.

4.4.3 FIRM.NOW:

The file consists of the latest available year's data of each firm. The file consists of 10 fields.

KEY, DESCRIPTION, DIVIDEND, EPS and PRICE are same as for FIRM.DAT.

CURRENT RATIO: Ratio of current assets to current liabilities.

DEBT TO ASSETS RATIO: Ratio of total debt to net worth.

SALES TO ASSETS RATIO: Ratio of net sales to total assets.

PROFIT TO ASSETS RATIO: Ratio of net profit to total assets.

BOOK VALUE: Book value of the firm's share.

The file is sequential.

UPDATING: As the data of a new year is available, the file is updated.

4.4.4 TEXT FILES.

These files store the information given to the user while running the package in the form of Help.

(i) GENERAL.HLP: This contains the general information of the package such as, the facilities provided, limitations etc.

(ii) TERMS: This contains various terms and their meanings.

(iii) DFLTS: This contains various default settings.

(iv) INDEX: This contains all the files and their descriptions.

(v) TECHNICAL.INF: This contains the help to be given on technical analysis i.e. information about various formations etc.

(vi) MAIN.MEN: Contains explanation of Main Menu.

(vii) UPDATE.MEN: Contains explanation of update menu.

(viii) GRAF.MEN: Contains explanation of menu for graphs.

4.5 ARRAYS USED:

Various arrays have been used for storing the data during the execution of the package. Important arrays and their descriptions are given below.

1. INDTND and IND$

INDTND contains the summarised data of all the industries being considered for selection. Each column is described below. IND$ contains the descriptions of the industries corresponding to rows in INDTND.

INDTND

Sales growth	Earnings growth	P/E average	Current yield	Current earnings	Key

2. FTR and FRM$

FTR contains the summarised data of all the firms in the selected industries and FRM$ contains the name of the firm corresponding to the rows in FTR.

FTR

Sales Growth	Earnings Growth	P/E Ratio	Current Yield	Current EPS	Key	Income	Risk

Income for an year is the dividend plus the growth in the price of the firm's share. This income is extrapolated to the future and the risk is the variance in the income.

3. FORMN:

This is used for storing a picture in medium resolution
graphics temporarily.

4.6 DATA COLLECTION:

For an effective decision making and for predicting an
industry's or a firms future performance and market trends,
a study of its past performance is necessary. This necessitates
collection of data of various firms pertaining to atleast last
tenx years. All this data regarding the firms has been collected
from BOMBAY STOCK EXCHANGE OFFICIAL DIRECTORY published by
Bombay Stock Exchange authorities, which is an authentic source.
For technical analysis, the only data required is the price of
various scrips in the past few years. However, for speculation,
a study of price history of part few months would be sufficient.
This data has been collected from Economic Times previous issues.

CHAPTER V

SALIENT FEATURES AND LIMITATIONS OF THE PACKAGE

This chapter discusses the salient features and the limitations of the package.

5.1   EFFECTIVE UTILIZATION OF MEMORY AND CPU:

A good package is characterized by effective utilization of memory it occupies and the CPU time it consumes while running the package. In developing the package, a strong attempt has been made to utilize these two facilities optimally.

The system uses sequential access files instead of Random access files. Sequential access files xoccupy much lesser space than the random access files. Another advantage with sequential access files is that numeric data can be stored and retrieved from these files. But in random access files, all the data should be stored in the form of character strings. Hence, each time some numeric data is to be retrieved, it should be retrieved into a string variable, and then converted into an integer or real variable. Similarly, when a numeric variable is to be stored into a random access file, it should be converted into a character string first and then stored in the file. Since most of the data to be stored in the files is

numeric and majority of the accesses and retrievals are sequen-
tial, the random access files are of little use for the present
work even though access and retrieval of data from a random
access file are faster than from a sequential access file.
Secondly, all the arrays are erased when their purpose is
completed, thus saving memory space. All the arrays have been
dimensioned such that minimum amount of memory space is used.
The CPU time consumption is attempted to be minimized by
effective use of various built in functions provided in BASIC.

5.2 MENUS AND CONTROL:

The package has been designed and developed such that it
gives absolute control to the user over the decision making
process. The user can control the system in each and every
event of the decision making process. He can set minimum and
maximum limits for various factors like growth, P/E ratio,
yield etc. The user can select the factor or factors on the
basis of which the industries are cut-off from the selection
list or he can add (or delete) some industries to (from) the
list of selected industries. For constructing the portfolio,
the user can specify the income expected on his investment and
the risk is minimized for the specified income.

For easening the performance of these control operations,
options of various operations are given to the user in the form
of 'menu's. The user can select any option in a menu and
depending on his option, the system branches to different
operations.

5.3   INTERFACE WITH THE USER:

For any Decision Support System, proper interface with the user is most essential. Even if a DSS provides extremely powerful functions, it may be of little use if the interface is not well designed.

In the present work, great emphasis has been given to effectively interface the system with the user. At every crucial event in the decision making process, the system interacts with the user and takes his directives. Various types of interface designs which are implemented in the package are discussed in the following sub-sections.

5.3.1   Question - Answer (Q/A) Interface:

This is a very common type of interface designs. The system requires various inputs from the user. Some of these inputs are used in decision making process, some are required for directing the system to perform a particular operation and some are required to take a particular course of action. For example, the system requires the minimum allowable rate of compound growth in sales in order to cut off the industries on the basis of sales growth. Hence, the system questions the user what is the minimum allowable rate of compound growth in sales. The user's answer is stored by the system and is used to cut off the industries on the basis of sales growth. Or the system asks the user whether he wants to see any firm's

performance history graphs or data, and if the users answer
is yes , the system takes the firm's description as input
and gives the menu of various graphs. If the answer is NO ,
the system skips the other queries and goes to the next event
in the process.

5.3.2 Menu Interface:

The question-Answer interface is convenient when the
system requires a value to be input by the user or a yes/no
answer. But when the system offers the user a number of alter-
natives and the user has to select one of the alternatives, the
menu interface would be very convenient. For example, when
he wants update. Hence the system gives a menu of all the
files and updation options and asks the user to select any of
the options. The selection is accomplished by typing the
serial number of the alternative in the menu.

The menu interface is quite effective for inexperienced
or in frequent users who are familier with the problem to be
solved.

5.4 UPDATING OF FILES:

The data which is used for analysis of firms should
be the latest possible because it helps taking effective deci-
sions regarding the selection of firms. Unless the latest
changes in the performance and capital structure of firms are
considered for decision making, it may lead to a wrong selection

of firms and hence may cause a loss to the user. Hence, the
user should essentially update the data files. Also, the user
may wish to expand the database by adding some new firms' data
to it.

In order to maintain a current database, the package
provides updating facilities, which enable the user to perform
various updation operations. The user can update the data of a
firm which already exists in the database. The system gives
the format in which the data should be entered. The system
will give error message and asks the user to enter the data
again if any data is missing. When a firm's data is updated,
i.e. data for another year is given, the system will automati-
cally update the data of the industry to which the firm belongs.
For example, if the user updates the data of Hindustan Motors,
the system will automatically update the data of Auto-Light
industry.

The user can also add a new firm to the database. The
user has to give the description of the firm and the industry
to which the firm belongs to. Then the system will give the
format in which the data should be typed, and will take the
data from the key board. The data of the relevant industry is
also updated by the system. Similarly, when the user wants to
add the data of a new firm which belongs to an industry which
is not present in the database, the user has to create the

industry in the database by giving the description and a key to it which is not equal to any of the industries keys which are already in the database.

5.5   THE HELP SYSTEM:

The user may or may not know the terminology of stock market. But it is inevitable to use this terminology when the system interacts with the user. Also, the user may not have sufficient knowledge to give directions to the systems. Though defaults have been set for all the input variables and the directives, the user may wish the system to do something other than the default but he may not know how to control the system. For avoiding these problems, the system has been developed so as to help the user at every stage of the decision making process by providing him with the explanations of the terms used and the menus given. The user can access the help at one key stroke and seek the information he needs and then can resume the decision making process. This feature of the package improves the user friendlyness and will be of great help to a user who is not acquainted with the share market jargon. However, a user who does not need any help from the system can work with the system as if the help system does not exist at all.

5.6   VISUAL AIDS:

The package the user with various visual aids which improve his conceptualization. A user who has little knowledge

of mathematics and finance, will greatly appreciate these visual aids. These improve the understandability of the messages or outputs of the system and hence accelerate the decision making process.

5.6.1 Line Graphs:

Line graphs with time on one axis and the performance characteristic (sales or earnings) on the other, help the user understand the history of a firm's or industry's performance. The user can have a better idea of growth by viewing the graph rather than knowing the average rate of compound growth of the performance characteristic. The user will be able to identify whether a single years performance affects the average rate of growth and thus can take corrective action.

In the technical analysis, the system provides the user with a line graph of the weekly closing prices of a scrip which helps the user identify any formations (line, triangle, head and shoulder etc). Also, for assisting the user in identifying these formations, the system gives the shapes of these formations in the right margin of the screen. The user can move these templates with the help of cursor keys on to the graph and match them with the graph of price on the screen. This facility greatly simplifies the process of identification of any formations in the graph even for a user who is unfamiliar with technical analysis of shares. For an expert user, the system gives the facility of drawing lines on the graph to assist in identifying any formations.

5.6.2 Tables and Pictures:

Various ratios, the selected industries and firms etc. are shown to the user in the form of tables. Tables give the required information in a compact and easily understandable format. The portfolio is depicted by a pie chart, giving the details of each scrip and the percentage investment in that scrip. This would give a better idea of the portfolio than giving the scrips and percentages in the form of a table. Another pie chart showing the percentage investment in each industry is also given to the user.

5.7 LIMITATIONS OF THE PACKAGE:

1.   The package does not consider relative advantages and disadvantages of a stocks face value, liquidity etc. It also does not analyse the effect of stock splits (bonus shares) and stock rights.

2.   In the technical analysis, the package can not identify the formations by itself. The user has to identify any formations and the system only assists him by giving the plot of the price, the templets of the formations and the facility to move the templates on to the price plot for matching. After identifying a formation, the user should himself make the decision whether to buy a scrip or not and the package only gives him the information about the formation.

3.   The user cannot change the inputs which he has given to the system in a run. If he gives some inputs wrongly, and if he wants to change them, he has to run the package again with the modified inputs.

4.   The package does not provide the user with the option of modifying or deleting some data in the data files. He can only update the data.

5.   While constructing the portfolio and selecting the firms, the system does not consider any risk factor other than the variance in the income. Also, it is assumed that all the stocks in the portfolio are independent of one another. If two or more stocks in the portfolio are dependent, the package under-estimates the risk.

6.   The system can not detect the natural language errors, like spelling mistakes in typing the data etc.

CHAPTER VI

CONCLUSIONS AND SCOPE FOR FURTHER WORK

6.1 CONCLUDING REMARKS:

The present work aims at constructing a system which supports decision making in stock market investment, which is a semi-structured problem . An attempt has been made to systematize the process of decision making of an investor and still provide the freedom of using his skills, knowledge and styles to the user. It is not intended that the system supercedes the decision maker, but helps him in making an effective selection of shares. The DSS incorporates various methods of stock evaluation which suit different goals of the investors.

Much of the emphasis had been given to the user-friendliness of the system and to the support of the decision making process of an investor who is unfamiliar with the stock market terminology and stock evaluation techniques. Various representations that are given to the user during the decision making process help easy understanding of the data and outputs and thus speeden the decision making. The system uses a database consisting of past and present data of various firms and the facilities of updating the database are provided.

6.2 SCOPE FOR FURTHER WORK;

The present work does not evaluate the performance of the portfolio constructed after the firms for investment are selected. The firms' performance or the market as a whole in future can be simulated and thus the outcomes of the decisions could be predicted. Also, one can improve the effectiveness of process of selecting scrips by incorporating more advanced techniques of forecasting and financial management.

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